



Death in the line of duty...

A summary of a NIOSH fire fighter fatality investigation

August 31, 2009

Volunteer Fire Lieutenant Killed While Fighting a Basement Fire - Pennsylvania

SUMMARY

On March 5, 2008, a 35-year-old male volunteer Fire Lieutenant (the victim) died while fighting a basement fire. About 30 minutes after the fire call had been dispatched and the crews had been evacuated from the structure and accounted for, a decision was made to re-enter the structure to try and extinguish the fire. The victim, an Assistant Chief (AC), and a Captain had made their way down an interior stairway to the basement area where the victim opened a 1 ¾-inch hoseline. Shortly thereafter, the Captain told the AC that he had to exit the basement stairs. A few seconds later, the AC told the victim to shut down the line and evacuate the basement because the fire was intensifying. The AC was second up the stairs and told a fire fighter at the top of the stairway landing that the victim was coming up behind him. The AC exited the structure while the fire fighter stayed at the top of the stairway and yelled several times to the victim, but received no response. The fire fighter exited the structure and informed the AC that the victim had not come up from the basement. The AC then notified the Incident Commander who activated a rapid intervention (RIT) team. The RIT made entry into the structure but was repelled by the intensity of the fire. After several more rescue attempts, the victim was removed from the building and later pronounced dead at the hospital. Four other fire fighters were treated for minor injuries and were released from the hospital. The following factors were identified as contributing to the incident: an absence of relevant standard operating guidelines; lack of fire fighter team continuity; suboptimal incident command and risk management; and lack of a backup hose line.

NIOSH investigators concluded that, to minimize the risk of similar occurrences, fire departments should:

- *review, revise as necessary, and enforce standard operating guidelines (SOGs) to include specific procedures for basement fires and two-in/ two-out procedures*
- *ensure that team continuity is maintained with two or more fire fighters per team*

The National Institute for Occupational Safety and Health (NIOSH), an institute within the Centers for Disease Control and Prevention (CDC), is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. In fiscal year 1998, the Congress appropriated funds to NIOSH to conduct a fire fighter initiative. NIOSH initiated the Fire Fighter Fatality Investigation and Prevention Program to examine deaths of fire fighters in the line of duty so that fire departments, fire fighters, fire service organizations, safety experts and researchers could learn from these incidents. The primary goal of these investigations is for NIOSH to make recommendations to prevent similar occurrences. These NIOSH investigations are intended to reduce or prevent future fire fighter deaths and are completely separate from the rulemaking, enforcement and inspection activities of any other federal or state agency. Under its program, NIOSH investigators interview persons with knowledge of the incident and review available records to develop a description of the conditions and circumstances leading to the deaths in order to provide a context for the agency's recommendations. The NIOSH summary of these conditions and circumstances in its reports is not intended as a legal statement of facts. This summary, as well as the conclusions and recommendations made by NIOSH, should not be used for the purpose of litigation or the adjudication of any claim. For further information, visit the Program Website at www.cdc.gov/niosh/fire or call toll free **1-800-CDC-INFO** (1-800-232-4636).



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- *ensure that the Incident Commander continuously evaluates the risks versus gain when determining whether the fire suppression operation will be offensive or defensive*
- *enforce standard operating guidelines (SOGs) regarding thermal imaging camera (TIC) use during interior operations*
- *ensure that a separate Incident Safety Officer, independent from the Incident Commander, is appointed and utilized when incidents escalate in size and complexity*
- *ensure that a backup hose line is pulled and in place prior to entry into fire-involved structures*
- *ensure that all fire fighters have portable radios and they are operable in the fireground environment*
- *ensure that fire fighters are trained on initiating Mayday radio transmissions immediately when they are in distress, and/or become lost or trapped*

While the following recommendation may not have prevented the death of the fire lieutenant, fire departments should:

- *ensure periodic mutual aid training is conducted*

INTRODUCTION

On March 5, 2008, a 35-year-old male volunteer Fire Lieutenant died while fighting a basement fire. On March 8, 2008, the Fire Commissioner from the State of Pennsylvania notified the National Institute for Occupational Safety and Health (NIOSH) of this incident, and requested an investigation. On March 24 – 26, 2008, a safety consultant under contract with NIOSH traveled to the fire department and held a meeting with the District Fire Marshal. Interviews were conducted with the assistant Fire Marshal, local medical examiner, 2nd incident commander (2nd IC), Assistant Chief, state police, and other fire fighters who were at the incident scene. The victim's and 2nd IC's training records, photographs of the fire structure, building diagrams, fire marshal's report and the fire department's standard operating guidelines were reviewed. The fire structure and the victim's personal protective equipment were examined and photographed by NIOSH.

FIRE DEPARTMENT

This volunteer department consists of 20 fire fighters operating from 1 station and serving a population of about 7,500 in a geographic area of approximately 1.1 square miles. Mutual aid was provided by Township volunteer fire departments.



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TRAINING AND EXPERIENCE

The Fire Lieutenant (the victim) had about 7 years of fire fighting experience, and had completed the following training: Basic Firefighting Skills; Vehicle Rescue; Structural Firefighting Skills; Hazardous Materials Response Skills; Rapid Intervention Team; Refresher in Basic Firefighting Skills; and Introduction to the Incident Command System.

The 2nd Incident Commander (2nd IC), who was in command at the time of the fatal incident, had more than 10 years of fire fighting experience and had completed the following training: Basic Firefighting Skills; Rapid Intervention Teams; Foam Response Training Program; Basic Fireground Operations; Carbon Monoxide Emergencies; First Responder Fire Investigation; Structural Firefighting Skills; Hazardous Materials Response Skills; Leadership for Company Officers; Vehicle Rescue; Rope Rescue I; Crew Leader; Basic Vehicle Rescue Technician; Fire Fighter Survival; Emergency Medical Technician; Managing Company Tactical Operations (Preparation and Decision Making); Pump Operator/Driver; National Fire Protection Association Fire Fighter Level I and II; Truck Company Operations; Firefighters Scared Straight; Instructor I; Instructional Techniques for Company Officers; Pump Operations I; Incident Command System; National Response Plan; Emergency Vehicle Driver Training; and Strategy and Tactics for Initial Company Operations. He had also completed Advanced Basics including: Engine, Truck, and RIT Operations.

PERSONAL PROTECTIVE EQUIPMENT

At the time of the incident, the victim was wearing the following array of personal protective clothing consisting of turnout gear (coat and pants), helmet, boots and a self-contained breathing apparatus (SCBA) with an integrated personal alert safety system (PASS). The victim also carried an operating radio, and he was found with his gloves off. One glove was found on the basement floor and the other glove was later found in a debris pile outside the structure. Also the Nomex® hood was found in the victim's coat pocket. The SCBA was sent to the National Institute for Occupational Safety and Health's (NIOSH) National Personal Protective Technology Laboratory for evaluation. The SCBA was evaluated as operating properly. See Appendix A for the NIOSH SCBA evaluation report.

Note: Not all fire fighters were equipped with portable radios, and the 2nd incident commander reported problems hearing messages because of static on his radio.

STRUCTURE

The fire building was a 2-story, single family residence constructed in 1956 (see Photo 1). The building style was Cape Cod, and was constructed with cinder blocks covered with stucco. The structure had an A-frame roof covered with asphalt shingles. The structure had a full basement which had been divided in half by a wall comprised of wooden studs covered with wood paneling. The basement area where the incident occurred, a 14-foot x 16-foot sitting room, was the first room located at the bottom of the stairway landing. The room was furnished, had wood paneling on the walls, a suspended drop ceiling constructed of 2-foot by 4-foot acoustical panels, and the floor was



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carpeted (See Diagram 1-basement floor drawing). *Note: The seat of the fire was reported to be behind the computer on the D-side wall of the basement, and the fire was electrical in nature.*

1ST IN COMPANIES (APPARATUS), PERSONNEL, AND ON-SCENE ARRIVAL TIMES

The response, listed in order of arrival (all times are approximate) and events, include:

- **0833 Hours:**
911 received a call of a structure fire: dispatch Station 61 to scene
- **0836 Hours:**
POV: Assistant Chief (1st Incident Commander [from an out-of-town volunteer fire department]) driving by scene, radios 911 to report fire
- **0840 Hours:**
Station 61 on scene: Captain, driver/operator, and two fire fighters (Township Company)
- **0843 Hours:**
Station 40 on scene: Assistant Chief, driver/operator, and one fire fighter (Township Company)
- **0845 Hours:**
Station 55 on scene: Assistant Chief, driver/operator, and two fire fighters (Incident Command)
- **0846 Hours:**
Station 55: Assistant Chief 9 assumes Incident Command (2nd Incident Commander)
- **0847 Hours:**
Station 72: Chief, Assistant Chief, driver/operator, and one fire fighter (Mutual Aid Company)
Engine 61 crew advances hoseline to top of basement steps
- **0848 Hours:**
Station 39: Deputy Chief, Assistant Chief, Lieutenant (the victim), driver/operator, and two fire fighters (Mutual Aid Company)
Station 55 Assistant Chief 9 assumes Incident Command
- **0858 Hours:**
Rescue 45: Chief, Assistant Chief, Captain, driver/operator, and one fire fighter (Mutual Aid Company)



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(See Apparatus placement diagram)

WEATHER

The weather was mostly cloudy with a 10-mile visibility. The temperature was around 49-degrees Fahrenheit, and the wind was from the west at around 17 miles per hour, gusting to 28 miles per hour. The wind was not reported as a factor in this incident by a consensus of the individuals interviewed including the fire marshal.

INVESTIGATION

On March 5, 2008, a 35-year-old male volunteer fire Lieutenant (the victim) died while fighting a basement fire in a residential structure. At approximately 0833 hours, 911 received a call of a structure fire in a residential building and dispatched the Township volunteer fire departments. Engine 61 (E61), which was en route to another call (downed tree) in the same area, was the first apparatus to arrive on scene at 0840 hours. Other companies dispatched were Engine 55 (E55), Engine 40 (E40), Rescue 39 (R39), Engine 72 (E72), and Rescue 45 (R45) which all arrived shortly thereafter.

At 0836 hours, an Assistant Chief from an out-of-town volunteer fire department was driving to work in the area of the downed tree and saw smoke coming from a dwelling. He used his portable radio to notify 911 of a dwelling fire, reporting heavy fire conditions from the basement window on the A/B side of the structure. A few minutes later, E61 arrived on scene and the Captain from E61 asked the out-of-town Assistant Chief to take command since some of his crew did not have portable radios. The Assistant Chief then assumed the 1st incident command (1st IC) as the pump operator from E61 connected a 5-inch supply line from a nearby hydrant to the engine and charged the handline. Two crew members from E61 advanced the 1 ¾-inch handline into the fire structure through the door on D-side as the other crew member stayed at the door feeding the line in. The interior crew encountered heavy smoke conditions as they made their way down a hallway on the first floor looking for the door to the basement. After a couple of minutes, the crew found the door to the basement, opened it and observed fire coming up the steps. At 0847 hours, they were hitting flames coming up the stairway when they lost water due to a hydrant problem. The crew backed out of the structure and another 5-inch supply line was connected to a different hydrant. The handline was charged again.

Around 0846 hours, an Assistant Chief from E55 relieved the 1st incident commander and assumed incident command (2nd IC). Around this time, the crew from E61 re-entered the structure, advanced to the basement door area, and started hitting the fire again until the Captain's low air alarm went off. As the Captain and his backup exited the structure, a Lieutenant and another fire fighter followed the line back into the structure to the top of the basement steps, and proceeded down the steps until they too had to back out due to high heat. At 0858 hours, they had made it back to the top of the basement stairs when an evacuation order (an alert tone was activated and air horns sounded) was issued and



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they exited the structure. At 0859 a PAR (personnel accountability report) was conducted and all fire fighters were accounted for by 0900.

All the crews met with the 2nd IC and a decision was made to try again to go to the bottom of the stairs and extinguish the fire. The crew from E72 set up on C-side to open the roof when needed, and Rescue 45 was standing by as the rapid intervention team (RIT). One crew entered the fire building on the first floor of A-side with a 1 ¾-inch charged handline to stop any fire extension on the 1st floor. The second crew, consisting of the victim who was on the nozzle of a 1 ¾-inch charged handline, an Assistant Chief (AC) as his backup, a Captain feeding the line, and a fire fighter who would control the line at the top of the basement stairway, entered the building on D-side (see Photo 1). The victim proceeded down the basement stairway with the AC and Captain close behind, while a fire fighter remained at the top of the stairway feeding and controlling the handline. Once the victim and AC made it to the bottom of the stairway they entered the room a few feet and the victim opened the nozzle and began to knock down the glow of the fire (see Photos 2 and 3). They encountered heavy heat and no visibility as they continued to knock down the fire. The Captain, who was located half way down the stairway, reported to the 2nd IC that they were putting water on the fire, needed ventilation, and still had a lot of heat but less fire. The heat began to increase rapidly and, at the same time, the low air alarm on the Captain's SCBA began to alarm. The Captain advised the AC that his SCBA was low on air and that he was getting hot and had to exit. The AC acknowledged okay, and the Captain started up the stairway. A few seconds later, the AC told the victim to shut down the line and evacuate the basement because the fire was intensifying. When the Captain reached the top of the stairway landing he heard someone else coming up behind him. The Captain exited the building through the D-side door and removed his helmet and face piece and then saw the AC exiting the door behind him. When he reached the top of the stairs, the AC told the fire fighter stationed at the top of the stairs that the victim was coming up behind him.

When the Captain and AC exited the building, the fire fighter at the top of the stairway landing, who did not have a radio, began calling out to the victim. He yelled his name several times and, when he received no response, he exited to the outside and informed the AC that the victim had not exited. The AC then advised the 2nd IC that a fire fighter was missing at around 0907 hours. The RIT was placed in service and advised that the last known location of the victim was near the bottom of the basement stairway. At 0909 hours, a second alarm and another RIT was dispatched.

At 0909 hours, the 1st RIT followed a handline into the structure and eventually located the basement stairway. One member of the RIT slid down the steps on his stomach while the other three were positioned on the steps and at the top of the stairway. The fire fighter, from the bottom of the steps, laid down and stretched out to try and locate the victim. However, smoke conditions and high heat prohibited the fire fighter from finding him. He exited the basement and he and the other fire fighters moved to the outside of the structure due to the increased heat and absence of protection of a back up handline. A handline was placed in service to control the fires now located in the 1st floor bathroom and bedrooms, while a 2nd RIT entered the structure to locate and extricate the victim.



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At 0930 hours, the 2nd RIT found the victim with the aid of a Thermal Imaging Camera and the sound made by his PASS device. He was about 6-8 feet from the bottom of the stairway (see Photo 4), but due to several of the RIT fire fighters SCBAs running low on air because of the extended time of the rescue attempts, the fire fighters had to exit. A 3rd RIT entered the structure and reported that the 1st floor conditions were deteriorating. Smoke, heat, and fire were making it unsafe for any rescue from the stairway connecting the 1st floor and basement. The 3rd RIT advanced down the stairway to the basement and located the victim. He was found on his left side in approximately 3-4 inches of water. His helmet and SCBA mask were on, but his gloves and hood were not. The victim was not trapped or entangled. A decision was made to remove the victim through the basement window on the A/B corner. The basement window was enlarged using a saw, and a ground ladder was placed through the basement window into the basement. A 4th RIT entered the structure and went down the stairway to the basement. They helped place the victim on the ground ladder. At about 0937 hours, a rescue rope was attached to the victim and he was slid up the ground ladder to the outside where emergency medical personnel waited (see Photo 5). The victim was transported by ambulance to the local medical center where he was pronounced dead at 1035 hours. During the rescue attempts, four fire fighters received minor injuries. They were treated at the local hospital and three were released that day while one required hospitalization for another day.

CAUSE OF DEATH

The Medical Examiner listed the cause of death as soot and smoke inhalation and extensive thermal burns.

CONTRIBUTING FACTORS

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. The NIOSH investigator identified the following items as key contributing factors in this incident that ultimately led to the fatality:

- an absence of relevant standard operating guidelines
- lack of fire fighter team continuity
- suboptimal incident command and risk management
- lack of a backup hose line.



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RECOMMENDATIONS/DISCUSSIONS

Recommendation #1: Fire departments should review, revise as necessary, and enforce standard operating guidelines (SOGs) to include specific procedures for basement fires and two-in/two-out procedures.

Discussion: Standard operating guidelines (SOGs) should be reviewed, revised as necessary, and enforced to include specific procedures for basement fires and two-in/two-out procedures. The SOGs for emergency operations should cover, but not be limited to, specific operations such as ventilation, water supplies, basement fires and two-in/two-out procedures. Basement fires present a complex set of circumstances, and it is important that SOGs are developed and followed to minimize the risk of serious injury to fire fighters.¹ The importance of ventilation when attacking basement fires cannot be overemphasized. Fire can quickly spread upward into the structure causing potential problems such as a flashover, backdraft, or weakening of the structure. Ventilation timing is extremely important and must be carefully coordinated with both fire attack and ventilation crews. Ideally, ventilation should occur just ahead of interior crews advancing their hose lines. Properly ventilating the heat and smoke from buildings can reduce the possibilities of potentially hazardous situations for fire fighters. The fire fighters performing ventilation tasks should be in communication with the fire fighters attacking the fire or entering the structure to coordinate their efforts.^{2,3}

Additionally, the two-in/two-out rule should be followed when making entry into a hazardous area. When at least two fire fighters enter a hazardous atmosphere they should remain in visual or voice contact with one another at all times, and at least two fire fighters should be located outside the hazardous atmosphere to be communication with each other through visual, audible, or electronic means to coordinate all activities, and determine if emergency rescue is needed.

The SOGs should be in written form and be included in the overall risk management plan for the fire department. If these procedures are changed, appropriate training should be provided to all affected members.⁴ Although the fire department involved in this incident had written general SOGs, the guidelines did not contain specific procedures for basement fires and two-in/two-out procedures.

Recommendation #2: Fire departments should ensure that team continuity is maintained with two or more fire fighters per team.

Discussion: Each fire fighter must be assigned to a team of two or more and be given specific assignments to help reduce the chance of injuries. Team continuity relies on some very important key factors: knowing who is on your team and the team leader; staying within visual contact at all times (if visibility is obscured then teams should remain within touch or voice contact of each other); communicating your needs and observations to the team leader; rotating to rehab and staging as a team; and watching your team members (practice a strong “buddy-care” approach). These key factors help to reduce serious injury or even death resulting from the risks involved in fire fighting operations by providing personnel with the added safety net of fellow team members. Following these basic rules helps prevent serious injury or even death by providing personnel with the added



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safety net of fellow team members. Fire fighter accountability is an important aspect of fire ground safety that can be compromised when teams are split up. Company or crew members should enter and exit the environment together.^{3.5}

Recommendation #3: Fire departments should ensure that the Incident Commander continuously evaluates the risks versus gain when determining whether the fire suppression operation will be offensive or defensive.

Discussion: The initial size-up conducted by the first arriving officer allows the officer to make an assessment of the conditions, and to assist in planning the suppression strategy. The following general factors are important considerations during a size-up: occupancy type involved; potential for civilians trapped in the structure; smoke and fire conditions; type of construction; age of structure; exposures; and time considerations, such as the time of the incident, length of time fire was burning before arrival, and time fire was burning after arrival.^{3.6} The Incident Commander must perform a risk analysis to determine what hazards are present, what the risks to personnel are, how the risks can be eliminated or reduced, and the benefits to be gained from interior or offensive operations.⁷ The initial size-up should include a complete 360 degree walk-around of the structure, if possible.

The size-up must include continued assessment of risk versus gain during incident operations. According to NFPA 1500 §A-6-2.1.1, “The acceptable level of risk is directly related to the potential to save lives or property. Where there is no potential to save lives, the risk to the fire department members must be evaluated in proportion to the ability to save property of value. When there is no ability to save lives or property, there is no justification to expose fire department members to any avoidable risk, and defensive fire suppression operations are the appropriate strategy.”⁴ Retired New York City Fire Chief Vincent Dunn states “When no other person’s life is in danger, the life of the firefighter has a higher priority than fire containment.”⁸

The first-responding officer, as well as the incident commander, needs to make a judgment as to what is at risk – people or property. This will help determine the risk profile for the incident.⁹

In this incident, the structure was not occupied at the time of the incident. Numerous attempts were made to find the seat of the fire until an evacuation order was given at 0858 hours. After meeting with the fire fighters, another attempt was made to gain access to the basement, and according to the fire marshal’s report,¹⁰ water was not applied to the seat of the fire until 33 minutes had elapsed from the time of dispatch. Fire had been affecting the structural integrity of the building for at least that long, and fire had extended from the basement into the 1st floor living room, bathroom, and bedrooms. Fire officers and fire fighters need to be fully trained on how different construction types, age of construction, exposures, time considerations etc., can affect fire development and how these factors can limit safe offensive operations.



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Recommendation #4: Fire departments should enforce standard operating guidelines (SOGs) regarding thermal imaging camera (TIC) use during interior operations.

Discussion: The fire department involved in this incident had a SOG regarding the use of thermal imaging cameras at structure fires; however, the SOG was not enforced at this incident. As part of an established SOG, for example, if the TIC is to be utilized in conjunction with the initial attack line, the user of the TIC should be within the vicinity of the nozzle operator. This serves two purposes: 1) The handline would be in a position to provide protection for the TIC operator and crew members operating in the vicinity of the nozzleman, and 2) The operator of the TIC could guide the nozzleman in stream placement after pointing out the hot spots, the seat of the fire, and any high heat conditions that may pose a hazard to crews operating in the vicinity. Fire departments should also provide training on the proper use and the limitations of TICs. This would help fire fighters understand how the TIC can best be utilized to support and enhance basic fire fighting tactics.

A TIC was used to eventually locate the victim at about 0930 hours. However, had a TIC been used in the early stages of the incident, it may have enabled the fire fighters to find the seat of the fire more quickly and extinguish it before the fire escalated.

Recommendation #5: Fire departments should ensure that a separate Incident Safety Officer, independent from the Incident Commander, is appointed and utilized when incidents escalate in size and complexity.

Discussion: According to NFPA 1561 *Standard on Emergency Services Incident Management System, 2008 Edition*, “The incident commander shall have overall authority for management of the incident. The incident commander shall ensure that adequate safety measures are in place (5.3.1 and 5.3.2).” This shall include overall responsibility for the safety and health of all personnel and for other persons operating within the incident management system. While the Incident Commander (IC) is in overall command at the scene, certain functions must be delegated to ensure adequate scene management is accomplished.¹¹ According to NFPA 1500 *Standard on Fire Department Occupational Safety and Health Program, 2007 Edition*, “as incidents escalate in size and complexity, the incident commander shall divide the incident into tactical-level management units and assign an incident safety officer (ISO) to assess the incident scene for hazards or potential hazards (8.1.6).⁴ These standards indicate that the IC is in overall command at the scene, but acknowledge that oversight of all operations is difficult. On-scene fire fighter health and safety is best preserved by delegating the function of safety and health oversight to the ISO. Additionally, the IC relies upon fire fighters and the ISO to relay feedback on fireground conditions in order to make timely, informed decisions regarding risk versus gain and offensive versus defensive operations. The safety of all personnel on the fireground is directly impacted by clear, concise, and timely communications among mutual aid fire departments, sector command, the ISO, other support groups, and the IC.

Chapter 6 of NFPA 1521, *Standard for Fire Department Safety Officer*, defines the role of the ISO at an incident scene and identifies duties such as recon of the fire ground and reporting pertinent



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information back to the Incident Commander; ensuring the department's accountability system is in place and operational; monitoring radio transmissions and identifying barriers to effective communications; and ensuring established safety zones, collapse zones, hot zones, and other designated hazard areas are communicated to all members on scene.¹² The ISO adds a higher level of attention and expertise to help the individuals. The ISO must have particular expertise in analyzing safety hazards and must know the particular uses and limitations of protective equipment.¹³ The IC can be assisted in managing on-scene fire fighter health and safety by delegating the function of safety and health oversight to the ISO.

During this incident a safety officer (ISO) was not formally established. An ISO at this incident could have assisted the IC with duties such as ensuring the use of a backup hose line, ensuring the use of a thermal imaging camera in the initial attack phase, ensuring appropriate and timely ventilation, and reporting back to the IC pertinent factors such as, time the fire had been burning, condition of floors/structure, and fire extension into the 1st floor rooms. This type of information is vital when decisions regarding risk vs. gain are being made.

Recommendation #6: Fire departments should ensure that a backup hose line is pulled and in place prior to entry into fire-involved structures.

Discussion: Klaene and Sanders state that “backup lines are needed to protect the crew on the initial attack line and to provide additional flow if needed. Backup lines should be at least as large as the initial attack line,” and, “Backup lines should always be in place to protect exit routes.”¹⁴ In this incident, there was no backup line at the side entrance when the interior attack teams were initially operating. Additionally, when the 1st RIT was trying to search for the victim (immediately after he was identified as being lost), no back up line was in service.

Recommendation #7: Fire departments should ensure that all fire fighters have portable radios and they are operable in the fireground environment.

Discussion: All fire fighters on the fireground should be equipped with a portable and operable radio. The radio is an essential tool for the fire fighter to communicate with incident command and team members. Fire fighters must receive training on the proper operation of portable radios in regards to their operation and the department's standard operating procedures on the fireground, from reporting interior size-up/conditions to the IC, as well as, transmitting a distress signal. Radio discipline includes using standard protocol and terminology; using clear, concise text; talking slowly; and listening.^{4,10} It is vital that each fire fighter be equipped with a radio to inform command of interior conditions and special hazards, and in case of an emergency.⁴ In this case, the 2nd IC had reported several times that he could not hear any messages because of static on his radio, and that some crew members of the 1st arriving units were not equipped with portable radios. Also, the fire fighter assigned to the top of the stairway during the incident was not equipped with a portable radio. In emergency situations every second counts. If the fire fighter at the top of the stairway had been equipped with an operating portable radio, perhaps he could have contacted the IC sooner with the missing fire fighter information and the RIT could have been activated more rapidly.



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Recommendation #8: Fire departments should ensure that fire fighters are trained on initiating Mayday radio transmissions immediately when they are in distress, and/or become lost or trapped.

Discussion: Fire fighters must act promptly when they become lost, disoriented, injured, low on air, or trapped. They must transmit a distress signal for themselves or a partner while they still have the capability. A Mayday should be called using appropriate terminology, i.e. *Mayday* for a life-threatening situation such as a missing member or *Urgent* for a potentially serious problem that is not life-threatening.^{15, 16} Emergency traffic receives the highest communication priority from the IC, Dispatch, and all fireground personnel. All other radio traffic should stop when this emergency traffic is initiated to clear the channel and allow the message to be heard. The quicker the IC is notified and a RIT team is activated, the greater the chances are of a fire fighter being rescued and surviving. Once a distress signal is transmitted (or not) the distressed fire fighter can and should activate his PASS device and the emergency button on his radio to increase the chances of being located. In this case, the victim had a radio but did not activate the emergency button.

Recommendation #9: Fire departments should ensure periodic mutual aid training is conducted.

Discussion: Mutual aid companies should train together and not wait until an incident occurs to attempt to integrate the participating departments into a functional team. The impact of differences in equipment and procedures need to be identified and resolved before an emergency where lives may be at stake. Procedures and protocols that are jointly developed, and have the support of the majority of participating departments, will greatly enhance overall safety and efficiency on the fireground. Once methods and procedures are agreed upon, training protocols must be developed and joint-training sessions conducted periodically to relay appropriate information to all affected department members.¹⁷

REFERENCES

1. NFPA [1997]. Fire protection handbook. 18th ed. Quincy, MA: National Fire Protection Association.
2. Brunacini AV [1985]. Fire command. Quincy, MA: National Fire Protection Association.
3. IFSTA [1998]. Essentials of Fire Fighting. 4th ed. Stillwater, OK: Fire Protection Publications. International Fire Service Training Association.
4. NFPA [2007]. NFPA 1500 Standard on fire department occupational safety and health program. 2007 ed. Quincy, MA: National Fire Protection Association.



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- 5 Fire Fighter's Handbook [2000]. Essentials of fire fighting and emergency response. New York: Delmar Publishers.
- 6 NIOSH [2005]. Career fire fighter dies and two career captains are injured while fighting night club arson fire – Texas. Morgantown, WV: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Fatality Assessment and Control Evaluation (FACE) Report F2004-14, p. 6.
- 7 IFSTA [2002]. Fireground support operations. 4th ed. Stillwater, OK: Fire Protection Publications. International Fire Service Training Association.
- 8 Dunn V [1992]. Safety and survival on the fire ground. Saddlebrook, NJ: Fire Engineering Books & Videos, p. 291.
- 9 Dodson, D [2005]. The art of first-due. Fire Engineering. Vol. 158, No. 3. March, pp. 135-141.
- 10 Holland, D[2009]. Upper Chichester Township, Fire Marshal's Office, Lower Chichester Township, Fire Department, Line of Duty Death Report.
11. NFPA [2008]. NFPA 1561: Standard on emergency services incident management system. 2008 edition. Quincy, MA: National Fire Protection Association.
12. NFPA [2008]. NFPA 1521: Standard for fire department safety officer. 2008 edition. Quincy, MA: National Fire Protection Association.
13. International Fire Service Training Association [2002]. Fireground support operations. 1st ed. Stillwater, OK: Oklahoma State University (chapter 10)
14. Klaene B, Sanders R [2000]. Structural fire fighting. Quincy, MA: National Fire Protection Association, pp. 280-281, 366.
15. Clark BA [2004]. Calling a mayday: The drill.
([http://cms.firehouse.com/web/online/Firefighter-Safety/Calling-A-MAYDAY--The-Drill/10\\$32431](http://cms.firehouse.com/web/online/Firefighter-Safety/Calling-A-MAYDAY--The-Drill/10$32431)). Date accessed: February 2009.
16. DiBernardo JP [2003]. A missing firefighter: Give the mayday. Firehouse, November issue.
17. Sealy CL [2003]. Multi-company training: Part 1. Firehouse, February 2003 Issue.



Fatality Assessment and Control Evaluation Investigation Report # F2008-08

Volunteer Fire Lieutenant Killed While Fighting a Basement Fire – Pennsylvania

INVESTIGATOR INFORMATION

This incident was investigated and the report written by Richard Braddee, safety consultant under contract to the National Institute for Occupational Safety and Health, Fire Fighter Fatality Investigation and Prevention Program. An expert technical review was conducted by Harry R. Carter, Ph.D., Municipal Fire Protection Consultant, Adelphia, NJ.

APPENDIX A

Status Investigation Summary of One Self-Contained Breathing Apparatus NIOSH Task Number 15682

Background

As part of the *National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program*, the National Personal Protective Technology Laboratory's Technology Evaluation Branch agreed to examine and evaluate one Mine Safety Appliances 30 minute, 4500 psi self-contained breathing apparatus (SCBA).

This SCBA status investigation was assigned NIOSH Task Number TN-15682. The SCBA, sealed in a corrugated cardboard box, was delivered to the NIOSH facility in Bruceton, Pennsylvania on April 4, 2008. Upon arrival, the sealed package was taken to the Firefighter SCBA Evaluation Lab (Building 108) and stored under lock until the time of the evaluation.

SCBA Inspection

The package was opened and the SCBA inspection was performed on April 16, 2008. The SCBA was examined, component by component, in the condition as received to determine its conformance to the NIOSH-approved configuration. The entire inspection process was videotaped. The SCBA was identified as a Mine Safety Appliances (MSA) model manufactured under NIOSH approval number TC-13F-258.

Overall, much of the unit is covered in dried mud. While there is no apparent damage to most components, the facepiece has sustained quite a bit of physical harm. The front housing where the regulator attaches is broken off, and the lens frame has a crack and a missing piece. The cylinder is discolored and has minor nicks and scratches across its exterior. The cylinder valve rubber end bumper is missing. Because of the damage to the facepiece, the SCBA could not be tested as received. A substitute facepiece provided by the submitter was used for performance testing.



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Personal Alert Safety System (PASS) Device

An ICM 2000 Personal Alert Safety System (PASS) device was incorporated into the pneumatics of the SCBA. As received, the batteries had been removed from the unit to prevent it alarming. During the inspection, the batteries were replaced and the PASS device was activated both manually and automatically. Although the unit appeared to function normally, it was not tested against the specific performance requirements of NFPA 1982, *Standard on Personal Alert Safety Systems (PASS)*, 1998 Edition. Because NIOSH does not certify PASS devices, no further testing or evaluations were conducted on the PASS unit.

SCBA Compressed Air Cylinder Contents

During the inspection it was noted that the compressed air cylinder was partially pressurized. An air sample was collected from the cylinder and forwarded to a laboratory for analysis. When the cylinder valve was opened to start sample collection, a hissing sound was heard coming from the area of the valve handwheel, indicating a possible leak. This sound stopped once the valve was fully opened.

Lab Services-ITR analyzed the sample in accordance with the standards and methodologies found in the Compressed Gas Association's standard, ANSI/CGA G-7.1, *Commodity Specification for Air*. The test results indicate that the sample met the standard for Grade D air. The sample also met OSHA's moisture content requirement in 29 CFR 1910.134(i)(4)(iii) as well as the more stringent moisture content guidelines published in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2002 Edition.

SCBA Testing

The purpose of the testing was to determine the SCBA's conformance to the approval performance requirements of Title 42, *Code of Federal Regulations*, Part 84 (42 CFR 84). Further testing was conducted to provide an indication of the SCBA's conformance to the National Fire Protection Association (NFPA) Air Flow Performance requirements of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*, 1997 Edition.

NIOSH SCBA Certification Tests (in accordance with the performance requirements of 42 CFR 84):

1. Positive Pressure Test [§ 84.70(a)(2)(ii)]
2. Rated Service Time Test (duration) [§ 84.95]
3. Static Pressure Test [§ 84.91(d)]
4. Gas Flow Test [§ 84.93]
5. Exhalation Resistance Test [§ 84.91(c)]
6. Remaining Service Life Indicator Test (low-air alarm) [§ 84.83(f)]



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National Fire Protection Association (NFPA) Tests (in accordance with NFPA 1981, 1997 Edition):

7. Air Flow Performance Test [Chapter 5, 5-1.1]

Testing was conducted on May 6 and 7, 2008. All testing was videotaped with the exception of the Exhalation Resistance Test and Static Pressure Test. The SCBA failed to meet the requirements of the Positive Pressure Test and the Gas Flow Test. While the unit did provide air during the tests, it did not meet the specific test requirements. The unit passed all other tests, including the NFPA Air Flow Performance Test, which suggests that minor servicing and adjustment would bring it back into full conformance. It was also noted that during the Rated Service Time Test and Positive Pressure Test, the bell alarm sounded later than expected. However, both the bell and electronic low-air alarms activated properly and reproducibly during the Remaining Service Life Indicator Test.

Summary and Conclusions

The SCBA submitted for evaluation was delivered to NIOSH on April 4, 2008 and inspected on April 16, 2008. The unit was identified as an MSA 30 minute 4500 psi SCBA, NIOSH approval number TC-13F-258. The facepiece is unusable due to damage, although it was judged that the rest of the unit could be safely pressurized and tested using a substitute facepiece. The integrated PASS device was activated and appeared to function normally. A sample of the air remaining in the cylinder was analyzed and found to meet applicable specifications.

The unit was subjected to performance testing on May 6 and 7, 2008. It met the requirements of all tests except the Positive Pressure Test and Gas Flow Test. Although it did not conform to the specific performance requirements, it appeared to be capable of delivering some air to the user.

In light of the information obtained during this investigation, NIOSH has proposed no further action at this time. Following inspection and testing, the SCBA was returned to the package in which it was received and stored under lock in Building 108 at the NIOSH facility in Bruceton, Pennsylvania, pending return.

If the unit is to be returned to service, the facepiece should be cleaned and repaired or replaced entirely. The cylinder discoloration and scratches should be visually examined by a qualified individual, the rubber end bumper replaced, and the leak at the valve handwheel addressed. The rest of the SCBA should be cleaned, repaired, and tested by a qualified technician.



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Photo 1. A and D-side of fire structure.
NIOSH photograph.



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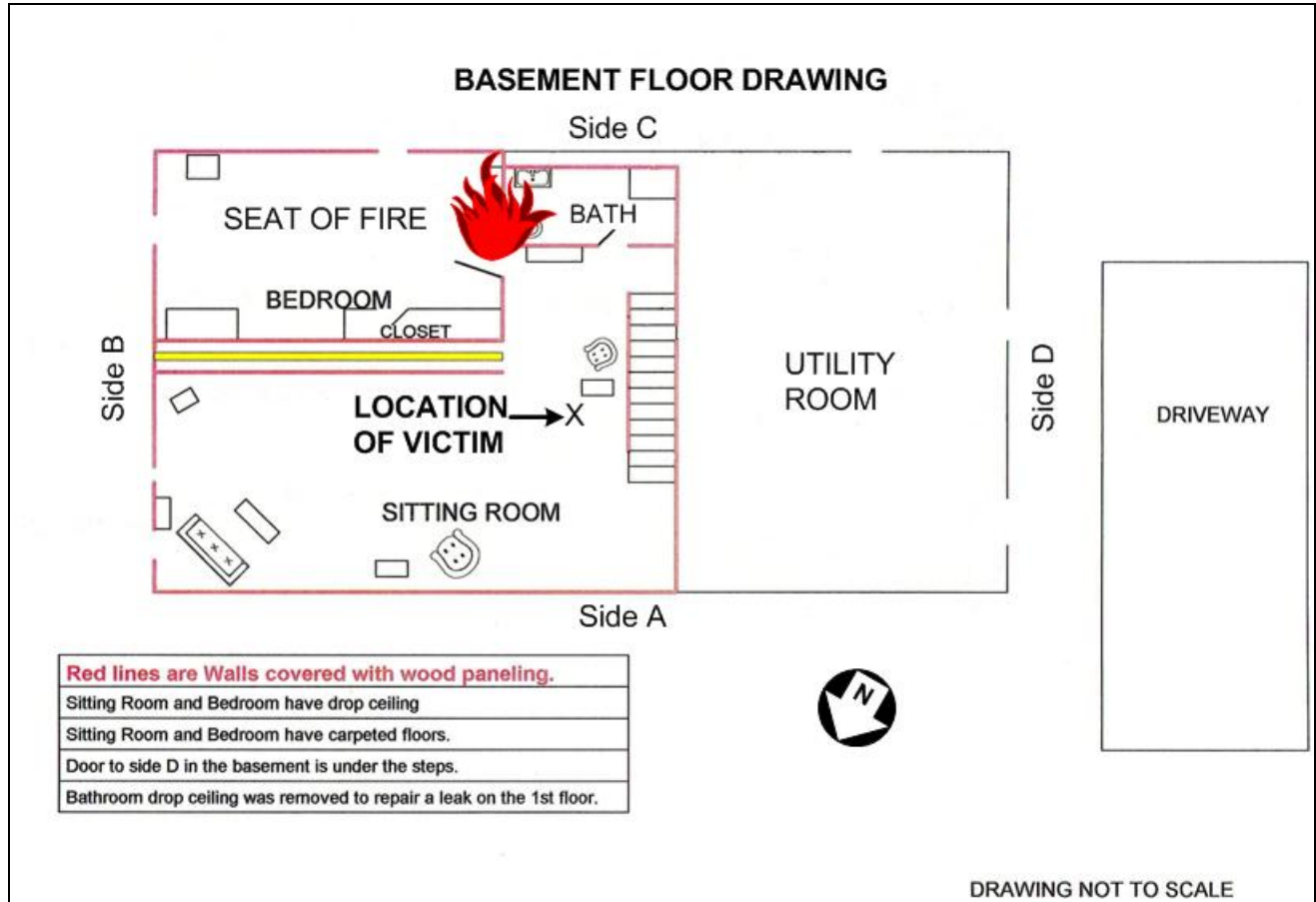


Diagram 1. Basement floor layout.
Diagram created from drawing provided by fire marshal's office.



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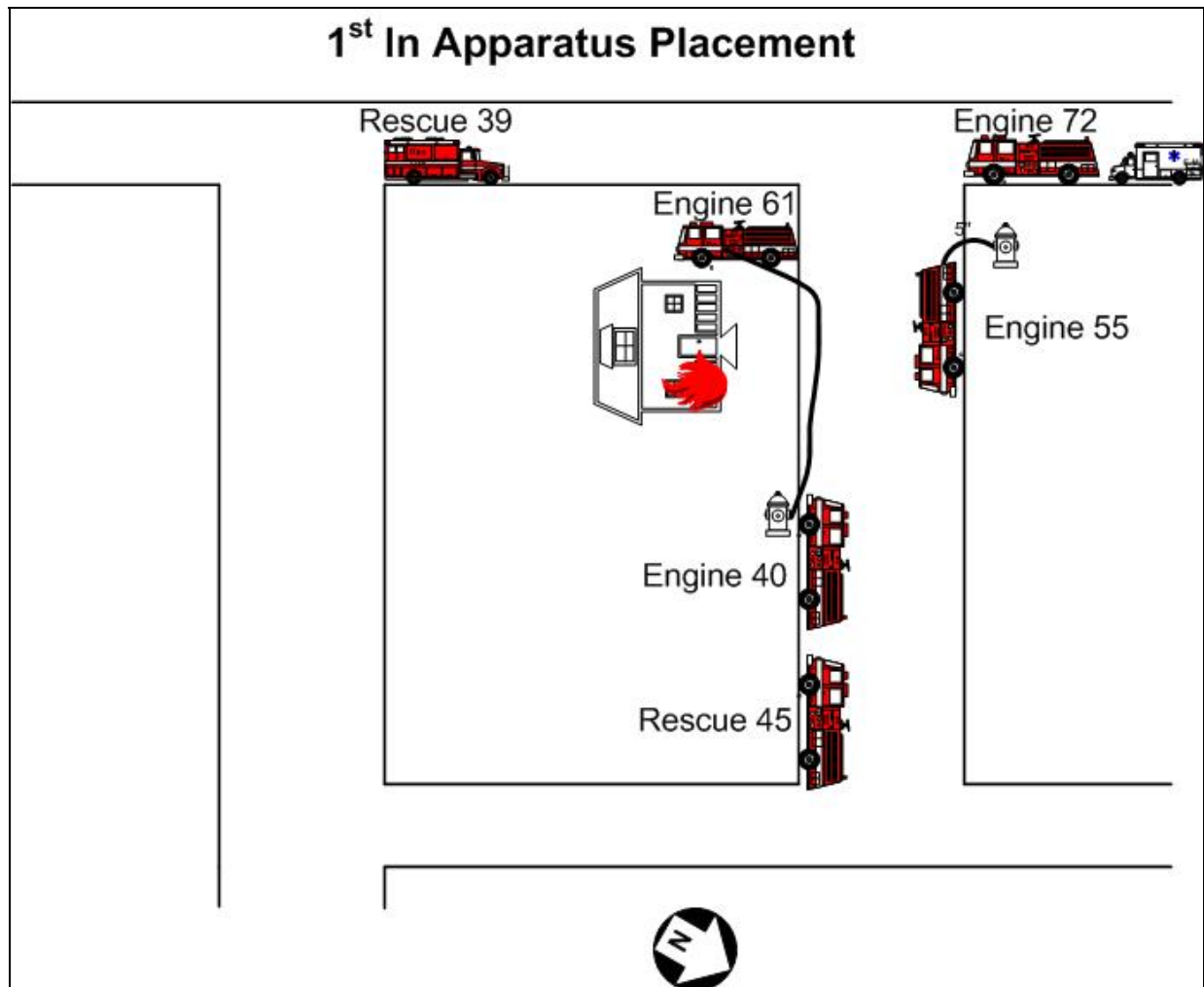


Diagram 2. First-in apparatus placement.
Diagram created from drawing provided by fire marshal's office.



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Photo 2. Stairway leading from 1st floor down into the basement.
NIOSH photograph.



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Photo 3. Side view of stairway leading from 1st floor down into basement.
NIOSH photograph.



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Photo 4. Approximate area in basement where victim was located next to stairway.
NIOSH photograph.



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Photo 5. A/B corner basement window where victim was eventually removed.
NIOSH photograph.